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The Diente Mining District

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Subject.

THE DIENTE MINING DISTRICT.

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The Diente Mining District.

Like every other camp whose ores are inaccessible to market at a profitable cost, the Diente Mining District has remained hardly developed until the advent of the smelters at Monterey. Since then large sums of money have been invested in the proper installation of machinery for the extraction and transportation of its product, and the deposits have been and are being worked systematically and on a large scale.

Location.

It is located thirteen miles south of Monterey on the Sierra Madre Range. Its name originated from a very high cliff which resembles a tooth (Diente).

It is reached from the city by the Mineral Belt Railway, a private road, belonging to the largest mining company in the district.

The mineralized part of this camp is about fifteen miles long the range by about two miles wide, thus giving an area of about thirty square miles. The mineral deposits extend farther northwest and southeast along the range but they belong to other camps.

Formation of the Mountain and Character of Ore Deposits.

The formation of the mountain is of pure lime rock which some geologists consider of the cretaceous age while the foot hills consist of calcarious shale.

In this district there are no fissure veins, the ore occuring in large deposits in the lime rock which seem to have been formed by the filling up of immense cavities of very irregular shape.

These cavaties or chambers have been formed by the percolating waters eating them out and have subsequently been filled with iron and lead ores.

It is probable that the filling took place by waters percolating through rocks of later formation, lying above the lime stone in which the caverns were formed, from which they abstracted the iron and lead to redeposit them in the limestone formation.

There are two classes of veins (if they may be so called) those striking with the mountain N 48 degrees -W. which follow the strike of the strata, and dip to the southwest and which are called longitudinal veins; and series of veins which run along the joint planes of the lime stone and nearly at right angles to the first mentioned veins and dip to the northwest. These are called transversal veins and differ from the longitudinals in carrying more silver with equal percentages of lead.

The width of these deposits varies between five and fifty meters. In the deposits, caves or unfilled parts of the cavities eaten out by the percolating waters are found, which vary in size according to the amptitude of the vein matter. They are generally coated with calcium carbonate either in the chamber crystal form or as stalactites and staligmites, which show plainly that they were water channels. The formation of this crust is considered to be due to the saturated condition of the percolating waters, having dissolved the lime from the mountain rock and deposited it on the walls of these caves.

The discovering of a cave is considered quite an advent for they often lead to ore bodies. The San Pablo mine owes its present condition to the discovery of the largest cave in the district. It is about one hundred meters long by sixty meters in width and with a height of one hundred meters. After sinking on the floor of this cave ore bodies were found which are still being followed three hundred meters below.

In this mine the deposit is a regular chimney. At present it has no connection with the deposits in the neighboring claims but undoubtedly one will be found,for it has the same strike and dip as the others.

As to the character of the ores they are oxidized,low grade,lead-silver ores with quite a percentage of iron,generally in the form of limonite, a small percentage of silica (6 to 10%) and from one to three percent of lime.

The amount of silver is very small,a 20% lead ore,carrying from four to five ounces per ton.

There is a peculiarity in the occurrence of silver. It does not vary directly with the percentage of lead,for it is common to see a lot of ore of high percentage in lead which will not run as high in silver as in iron ore which does not contain over five percent lead. It is believed that the silver occurs as a chloride,but a microscopical examination of the ores has not been made and this belief is only a hypothesis.

Underground Work.

The work done underground in a mine may be divided into three general classes:

Prospecting or Exploratory Work, Preparatory work and Exploitation work. I will consider each one and describe briefly the methods used in this camp.

Prospecting is carried on by means of drifts,crosscuts and winzes, except when the deposit is cut by means of a tunnel and then upraising plays an important part.

Drifts are run along the vein with the necessary crosscuts to determine, if in ore,the width of the deposit,while if in a barren portion of the vein,to investigate the walls,

The dimensions of these workings are generally 1.80 m high by 1.30 m in width.

In prospecting the ore downward a system called "pazo y portilla ", which might be translated as winze and offset,is used,which consists in sinking to a depth of five or six meters and then making an offset and sinking again,always following the ore. These winzes being too irregular to do any hoisting,the ore or waste,as the case may be,is taken out on men's backs,the ladder used being round logs with notches cut into them at about ten inches apart.

This system of sinking is continued to a depth of 35 to 50 meters where a level is established and drifting commenced. If the amount of ore in sight can be worked with profit preparatory work is begun,which might be shaft sinking or tunnelling. As an example of this kind of work which has been done in the largest mines in the district (the San Pedro and San Pablo Mines which are adjoining one another and worked by the same concern) for the proper exploitation of the deposits. There are two shafts 200 meters deep and two more 70 meters each. These are sunk with compressed air drills and their dimensions are 2 X 2 meters. Afterwards to do away with hoisting,the amount of ore in sight,being enough to allow for the cost of a long tunnel,one called the Hydalgo Tunnel was driven 200 meters below the mouths of the shaft,through lime rock for a distance of 1600 meters. This was also driven by compressed drills and the cost per meter was about $35.00 the dimmansions of the tunnel being 2 X 2.

In exploitation work the method used is altogether over hand stoping and square setting. This system is so well known that it is hardly necessary to desribe it. The dimensions of the setts are 7' X 7' X 7'

The New York Stope is the largest one in the district,having about 200 square setts and a height of 28 setts. The timbers used are 10" X 10" American Timbers.

Underground Traffic.

For the transportation of mineral along nearly level road from the working face of the shaft and on cages up the shaft,various forms of cars are employed,according to the use for which they are intended. In the levels where the cars have to ascend up the shaft on the cage they are generally 28 cubic feet in volumne,and end dumping which is easily effected by opening at the end a swinging door hung on two hinges from an iron rod across the top. In the tunnel,where mules are employed for hauling the cars,they are of larger capacity and end dumping. The tracks consist of 12 pound rails and are 18 " gauge. Generally there is but one track with simple turncuts and plain frogs and at junctions a simple iron plate 1/4 " thick laid on strong timbers is used. The trammers pull the end of the car around and shift it to the desired track where it is run off.

At the San Pedro Tunnel,which has a very steep grade an endless cable is used so that the loaded cars,coming out pull in the empty ones. For this system two tracks are necessary and the cars are attached to the cable by means of a chain and clip. This system is very economical,three men being sufficient to attend to the traffic in the tunnel,one attending to the braking wheel at the upper terminal,another one hitching cars on the cable and the third one disconnecting them at the south of the tunnel. The capacity of this arrangement depends wholly on the number of cars on the cable,for it cannot be run at a higher speed than three or four miles an hour.

While prospecting underground,wheelbarrows and packing the ore in sacks to be carried by men,consitute the only means of transportation.

Surface Transportation.

Owing to the topographical conditions of the mountains and the extent to which the different mines in this camp are worked,one meets with various means of transportation,from the pioneer burro to the most up to date aerial tramway or gravity incline plane. In small mines,which are inaccessible to wagons,jacks consitute the only means of transportation. The ore is sorted,sewed up into sacks,containing about ninety pounds each,and packed one on each side of the burro. In mines of larger output the aerial tramway has replaced them.

The Zaragoza Mine located by the Diente,has in operation two cables very cheap and simple to erect and operate,but which cannot be used in every locality.

They consist of two carrying cables,one and one-fourth inches in diameter,with a single span from the upper to the lower terminal and a pulling cable 5/8",the ends of which are attached to the buckets. On the upper terminal the pulling rope goes around a braking sheave to regulate the speed of the buckets which hold about half a ton of ore. This tramway is self acting and very safe,the two arms holding the buckets being on each side of the cable,the only chance for accident being the breaking of the ropes.

Of a somewhat similar style there is another small cable in operation from the upper mines to the upper terminal of the San Pablo Aerial Tramway,the main difference being that it has an intermediate tower,thus rendering it impossible to hang the buckets from the carrying rope in

the same manner as in the first mentioned case. In this cable two sheave wheels instead of one rest on the guide rope and from the middle point of their connected axels the arm holding the bucket is attached on the outside of the cable so as to clear the intermediate station.

Although this cable is not as safe as the Zaragoza, no serious accident has been recorded. In the San Pedro and San Pablo mines which are the most important ones in the district, larger tramways are in operation. The San Pablo Aerial Tramway is of the Hallidie and Huson patent, that is, a single endless wire rope supported by sheaves which are mounted vertically on the end of cross arms fixed to the necessary towers. The buckets are suspended by slips which are clinched around the rope at intervals of about one hundred feet. They are so small that they pass uninterruptedly over the rims of the supporting sheaves and around the terminal pulleys. At both ends of the line the cable passes clip pulleys set horizontally. At the upper terminal a brake is attached to this wheel to regulate the speed of the tramway, while at the lower end the clip pulley is on a carriage frame, the tension being kept constant by means of heavy weights. The length of this line is about 2000 meters and the difference in level between the terminals is about 600 meters. It has a capacity of 200 tons in twenty-four hours at a cost of 15¢ mexican money, per ton.

The tramway in operation from the San Pedro Mine to the Railway cars is of the Bleichert system. In this patent, instead of an endless cable like the above mentioned, there are two ropes, the carrying rope which serves as a roadway for the sheaves to which the buckets are attached, and the pulling rope, to which is an endless cable passing around pulleys at the upper and lower terminals and to which the buckets are attached by

means of a grip which can be easily thrown off and on at the terminal. The length of this line is about 2500 meters with a tension station for the guide ropes at the middle point of the line and a difference in elevation between the two terminals of 590 meters.

The cost of transportation over this cable is higher than over a single cable,but it ~~was~~ can handle a larger amount of ore with more safety. The present capacity of this cable is 300 tons in twenty-four hours,but it could be increased a great deal by running the cable at a higher speed and increasing the number of buckets.

Hidalgo Gravity Tramway.

The last mentioned two aerial tramways are handling the out put of the San Pedro and San Pablo Mines,but the ore is being hoisted a distance of 200 meters. Having finished a tunnel which connects the two mines at the bottom of these shafts the idea was to do away with hoisting and use this tunnel for the extraction of the ores,after the proper installation of machinery at the mouth of the tunnel for transporting the product to the Railway cars and thus the construction of this Gravity Tramway was decided upon.

Selection of the Site.

For the selection of the site for the tramway,a transverse survey was run from the tunnel mouth to a ridge,some 125 meters,on about the same level as the tunnel and from this point down the ridge nearly on a straight line to the railway cars below.

Contour points were taken short distances on each side of the line, judging from the m another line eight meters to the south and parallel to the first was run and after comparing the profiles the last one was

accepted,the slope of the mountain being more advantageous.

For the final location of the selected line,which should be a perfectly straight one,the following method was used: Having two points already established which determined the direction of the line to be prolonged,the transit was carefully centered over the forward point, putting one pair of the levelling screws on the line,then the horizontal limb was clamped and the instrument levelled carefully and turned on the rear point, the bubble at right angles to the limb relevelled,and the cross hairs made to bisect the rear point. Then the telescope was revolved and a forward point set,-this was a small nail in a wooden plug. Afterwards the alidade was unclamped and revolved about the vertical axis until the rear point was in the field of the telescope,and then clamped,the bisection being made by means of the tangent screw. Then the telescope was again revolved about its horizontal axis and a second point set beside the first,the middle distance between the two points being the point over which the prolongation of the line would pass. Sights were taken as far as the topography of the mountain would allow,and every time a new station was made the same operation was performed.

The total length of the line is 946 meters with a maximum slope of 37 degrees and 00 seconds and a minimum of eight degrees,thus giving an average slope of 22 degrees and 30'. For the grading of the road,stakes were set forty to fifty meters apart,and at these points the distances to be cut or filled in given to the contractor.

The fills were made with mortar and rubble masonry to make them substantial while the cuts were carried to solid ground,thus obtaining a very solid road bed.

The level of the upper terminal is slightly lower than that of the tunnel mouth to allow a grade of about 0.3 percent for the mine track. In selecting the profile symmetry was aimed at in a manner that when the loaded car is on a steep incline the ascending car will also be on a steep grade,and the same is true regarding the lower regions.

The Track.

The track will consist of three rails with a turnout in the middle forty meters long. The rails will be twenty-four pounds to the yard, or a total of forty-one tons of 2000 pounds each will be required. They will rest on oak ties 8' X 8" X 6",3 feet apart from center to center. On the steep places the ties will be bolted to the ground to prevent slipping. At regular intervals along the track,rollers will be placed to prevent the cable from cutting the ties and at the same time wearing itself.

There will be three styles of rollers used, a solid iron roller with a chilled rim in the middle for the steep places,an iron cylinder roller for the turnout,and common wooden rollers for the rest of the track.

Head Gear.

The head gear for the upper terminal will consist of three sheave wheels six feet in diameter,arranged as shown in the drawing of "General Arrangement of Tramway",two serving as braking wheels and the other as a mere idler. The break rod extends to the ore bin close to the gate wheels so that one man may handle both .

The brake is arranged with a weight so that it is always on, and thus the chances for accident diminished. To take the brake off the weight is raised by means of a block and tackle.

The Cable.

The size of the cable was determined by calculation, taking the strain on it for the steepest grade of the tramway and using a factor of safety between eight and nine. The size is 7/8" steel wire hoisting.

The Cars.

The cars used are self dumping, of eight cubic feet in volumne, and having a capacity of three and one-third metric tons of wet ore of average lead grade. Six such carloads, three on each end, would fill a railway car, all of which have a capacity of twenty metric tons.

The cars have been designed so that when going up the average grade their tops will be horizontal and the hind wheels tangent to the tension of the back end of the car. The other set of wheels are placed so that a vertical line, passing through the center of gravity of the car will also pass midway between the wheels. These requirements are essential for the stability of the cars.

The cable will be attached to the car by means of a turn buckle so that the length of the cable may be adjusted very closely. Besides the ore cars there will be a timber car attached to the cable by means of a chain and clamp and at such a distance from it that when the former is under the ore bin the latter is on the level. These timber cars will be used for the transportation of the mine supplies which would necessarily have to be taken over this tramway.

Ore Bins.

The ore bins from which the tramway will be fed are located vertically above the tracks of the inclined plane. They are square in section with an open square in the center. In the lower part there are two gates in each side of the central square(eight in all) which are operated by a rack and pinion arrangement from the breaking and sorting floor. These are located so that a man may handle them together with the brake for the head gear,all the work in the tramway being performed by one man,who loads, unloads and attends to the brake. The capacity of the bin is 300 metric tons of wet ore and the bin is divided into four compartments each of which can be subdivided into two smaller compartments of 37 1/2 tons each.

The ore bin consists of two floors,the track floor of the mine cars to dump the ore into the bin and the breaking and sorting floor where the ore that does not go through the grizzlies is broken into smaller lumps and sorted. The grigzlies are under the track floor,making an angle of 45 degrees with the horizontal. The cars are 2" apart,the ore to be handled being very wet.

In the lower terminal the cars will dump automatically and directly into the railway cars,as the latter are lowered by gravity past the lower terminal.

Capacity of Tramway.

For calculating the capacity of the tramway we will assume that the time required for loading and lowering a car of ore would be twelve minutes, which would be the time lost loading and unloading the mine supplies that would have to be transported on the timber car. If this assumption iscorrect the capacity of the tramway will be 400 tons in twenty-four hours.